Designing Computer Experiments to Determine Robust Control Variables

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Abstract

This talk is concerned with the design of computer experiments to choose robust sets of control input variables when there are two types of inputs: control variables and environmental variables. Control or manufacturing variables are determined by a product (or process) designer while environmental or noise variables are determined by field conditions but take values that are assumed to characterized by a probability distribution. Roughly, our goal is to find a set of control variables at which the response is insensitive to the value of the environmental variables, a "robust" choice of control variables. Such a choice ensures that the mean response is as insensitive as possible to perturbations of the nominal environmental variable distribution. This talk presents a sequential strategy to select the inputs at which to observe the response and a corresponding strategy to determine a robust setting of the control variables. The solution is Bayesian; the prior for the output function is a stationary Gaussian stochastic process. Given the previous information, the sequential algorithm computes, for each untested input, the "improvement" over the current guess of the optimal robust setting. The design selects the next site to maximize the expected improvement criterion. This is joint work with Jeffrey S. Lehman (Battelle Memorial Institute) and William I. Notz (Ohio State University).

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